CALIBRATED SPECTRUM
ANALYZING RECEIVER
MODEL CSR-200

MP MASTER
MA30034

FAIRCHILD
ELECTRO-METRICS
CORPORATION

CALIBRATED SPECTRUM
ANALYZING RECEIVER
MODEL CSR-200

NOTICE

The Calibrated Spectrum Analyzing Receiver Model CSR-200, is comprised of the Spectrum Display Module Model SPD-125, Interference Analyzer Model EMC-25, and interconnecting cables.

The Spectrum Display Module Model SPD-125 is comprised of the Spectrum Display Model PP-125, the Time Base Model 7414 and the Oscilloscope Main Frame Model 767H.

Under cover of this document is contained three instruction manuals, one for each of the above units which comprise the SPD-125 Spectrum Display Module. Each manual is self-contained. The manual for the PP-125 Spectrum Display however, contains specific information concerning its operation as part of the CSR-200. Manuals for the Time Base Model 7414 and for the Oscilloscope Main Frame Model 767H contain information on these units only, without reference to their relationship in the CSR-200.

Information concerning the operation, maintenance and repair of the EMC-25 Interference Analyzer is contained in a separate manual.

TABLE OF CONTENTS

Instruction Manual, PP-125 Spectrum Display

Oscilloscope Manual, Model 767H Oscilloscope

Instruction Manual, Model 7414 Time Base

TABLE OF CONTENTS

		Page
SECTION I	INTRODUCTION	1-1
1.1	THE MANUAL	1-1
1.2	THE SPECTRUM DISPLAY PP-125	1-1
1.3	ELECTRICAL SPECIFICATIONS	1-2
1.3.1	Frequency Range	1-2
1.3.2	Power Requirements	1-3
SECTION II	THEORY OF OPERATION	2-1
2.1	GENERAL	2-1
2.2	BLOCK DIAGRAM DISCUSSION	2-1
2.3	CIRCUIT DISCUSSION	2-4
2.3.1	175 KHz IF Amplifier	2-4
2.3.2	1.6 MHz IF Amplifier	2-4
2.3.3	8.7 MHz IF Amplifier	2-5
2.3.4	Video Amplifier	2-6
2.3.5	Sweep Control	2-6
2.3.5.1	Function Switch Settings	2-7
2.3.5.1.1	Spectrum and Locator Positions	2-7
2.3.5.1.2	Signature Position	2-7
2.3.5.1.3	Video Position	2-8
2.3.5.1.4	Bright-Up Circuit	2-9
SECTION III	OPERATION INSTRUCTIONS	3-1
3.1	GENERAL	3-1
3.2	UNPACKING	3-1
3.3	ELECTRONIC SHIPPING DAMAGE	3-1
3.4	INSTALLATION	3-2
3.4.1	Electrical Installation	3-2
3.5	CONTROL FUNCTIONS	3-3
3.5.1	Function Switch	3-3
3.5.1.1	Spectrum Position	3-3
3.5.1.2	Locator Position	3-5
3.5.1.3	Signature Position	3-5
3.5.1.4	Video Position	3-5
3.5.2	Contrast Control	3-5
3.5.3	Position Switch	3-5
3.5.4	Dispersion Control	3-6
3.5.5	Video Filter	3-6
3.5.6	Display (Log/Lin)	3-6

		Page
3.5.7	Log Gain Control	3-7
3.5.8	0 - 20 DB Switches	3-7
3.5.9	Attenuator Control	3-7
3.5.10	Remote Connector (J6)	3-7
3.5.11	AM Video (J8)	3-7
3.5.12	Post IF (J7)	3-8
3.5.13	SPD Normal Switch	3-8
3.6	OPERATIONAL PRECAUTIONS	3-8
3.6.1	Connectors	3-8
3.6.2	Adjustments	3-8
3.7	OPERATION PROCEDURE	3-9
3.7.2	Initial Control Settings	3-9
3.7.3	Response Amplitude - Log Display	3-9
3.7.3.1	Amplitude	3-9
3.7.4	Response Amplitude Lin Position	3-11
3.7.5	Response Frequency	3-11
3.7.6	Signature Response (Expanded Response)	3-12
3.8	VIDEO RECEPTION	3-13
3.9	HORIZONTAL SWEEP SPEED LIMITATIONS	3-14
SECTION IV	SERVICE AND MAINTENANCE	4-1
4.1	GENERAL	4-1
4.2	REPLACEMENT OF ASSEMBLIES	4-1
4.3	PERIODIC SERVICE	4-3
4.4	TEST EQUIPMENT REQUIRED FOR CALIBRATION AND ADJUSTMENTS	4-3
4.5	SPECTRUM DISPLAY PP-125 CALIBRATION AND ADJUSTMENTS	4-4
4.5.1	Spectrum Display PP-125 Test Setup	4-4
4.5.2	Spectrum Display PP-125 Sweep, Calibration and Adjustments	4-5
4.5.2.1	Log Gain Adjustments	4-5
4.5.2.2	Tuning Adjustment	4-7
4.5.2.3	Spectrum Sweep Range Adjustments	4-7
4.5.2.4	Locator Adjustments	4-8
4.5.2.5	Signature Adjustments	4-9
4.5.3	Spectrum Display PP-125, IF Gain Adjustments	4-10
4.5.3.2	175 KHz IF Gain Adjustment	4-11
4.5.3.3	1.6 MHz IF Gain Adjustment	4-11
4.5.3.4	8.7 MHz IF Gain Adjustment	4-12
4.5.4	Recorder Input Adjustments	4-12
4.5.4.1	Recorder Input Adjustment Test Set Up	4-12

Page

4.6 TROUBLESHOOTING 4-13
4.6.1.1 IF Amplifier Malfunction 4-13
4.7 ASSEMBLY REPAIR 4-14

SECTION V REFERENCE DATA 5-1

5.1 GENERAL 5-1

LIST OF ILLUSTRATIONS

		Page
Figure 2.1	Spectrum Analyzer CSR-200, Block Diagram	2-2
Figure 2.2	Function Switch Setting, Signature	2-8
Figure 2.3	Bright-Up Circuit, Simplified Diagram	2-10
Figure 3.1	Oscilloscope Main Frame Modulation	3-3
Figure 3.2	Spectrum Display PP-125, Front Panel Controls and Adjustments	3-4
Figure 4.1	Replaceable Assemblies with Calibration Adjustments	4-2
Figure 4.2	Spectrum Display PP-125, Test Setup	4-5
Figure 4.3	Recorder Input Adjustments, Test Setup	4-12
Figure 5.1	Schematic Location Guide	5-1
Figure 5.2	Spectrum Display PP-125, Main Chassis (A1)	5-2
Figure 5.3	8.7 MHz IF Amplifier (A1A1), Schematic Diagram	5-3
Figure 5.4	1.6 MHz IF Amplifier (A1A2), Schematic Diagram	5-4
Figure 5.5	175 KHz IF Amplifier (A1A3), Schematic Diagram	5-5
Figure 5.6	Sweep Control (A1A4), Schematic Diagram	5-6
Figure 5.7	Video Amplifier (A1A5), Schematic Diagram	5-7

LIST OF TABLES

Table 1-1	IF Selection	1-2
Table 2-1	BCD Code from EMC-25 Analyzer	2-3
Table 3-1	Initial Control Settings	3-10
Table 4-1	Replaceable Assemblies	4-3
Table 4-2	Test Equipment Required	4-4
Table 4-3	Preliminary Front Panel Adjustments	4-6

SECTION I

INTRODUCTION

1.1 THE MANUAL

This manual includes all relevant information for the successful operation, maintenance and repair of Spectrum Display PP-125. Information related to the operation, maintenance and repair of the 767-H oscilloscope, Time Base Model 7414, and Interference Analyzer EMC-25 is referenced in their respective manuals.

Special attention is directed to Section II, Theory of Operation. A thorough understanding of this section will enhance the performance of troubleshooting procedures. Section III relates to the operation of the equipment. This section is intended as an aid to both operating and maintenance personnel.

1.2 THE SPECTRUM DISPLAY PP-125

The Fairchild Spectrum Display PP-125 is a special purpose plug-in adapter for the Model 767-H oscilloscope.

One of three intermediate frequencies selected by the EMC-25 analyzer is amplified and detected by the PP-125, and presented as video information to the SPD-125. Special front panel controls permit video presentation of all or a portion of the spectrum being analyzed. Zero to 40 DB attenuation, gain control, choice of linear or logarithmic display, video filtering, position, and function switching are controlled from the front panel. Inputs for AM video and post IF from the EMC-25 are also front panel located.

Internal adjustments located on the sweep control board (A1A4), IF (A1A1 through A1A3) and video (A1A5) are preset for use with a given CSR-200 system.

1.3 ELECTRICAL SPECIFICATIONS

1.3.1 FREQUENCY RANGE. The usable frequencies are inputs of 8.7 MHz, 1.6 MHz and 175 KHz. These are intermediate frequencies originating in the EMC-25. Table 1-1 lists the IF selection and its association with a particular band utilized by the EMC-25. The IF amplifier used within the Spectrum Display PP-125 is also given.

TABLE 1-1

IF SELECTION

To Be Supplied by Fairchild

1.3.2 POWER REQUIREMENTS. The Spectrum Display PP-125 requires +50 V, -50 V, +100 V, and +200 V for operation. Since the PP-125, as an interface between the EMC-25 and the SPD-125, is physically a plug-in unit for the SPD-125; its power is derived by way of J9001 (Y input).

SECTION II

THEORY OF OPERATION

2.1 GENERAL

The Spectrum Display Model PP-125 is a special purpose plug-in, used with the Model 767-H Oscilloscope and the Model 7414 Time Base plug-in. Combined, these three units comprise the CSR-200 Calibrated Spectrum Analyzing Receiver.

2.2 BLOCK DIAGRAM DISCUSSION (Figure 2.1)

The logarithmically detected AM signal from the EMC-25 analyzer is fed to the log gain control circuits in the PP-125. With the DISPLAY switch in the LOG position, the directly coupled instantaneous log output of the analyzer is delivered to the scope. The scope presentation will then be logarithmically compressed video information.

The linearly detected signal at the IF frequency and bandwidth of the band selected at the EMC-25 analyzer is fed to an attenuator network in the PP-125. The applicable spectrum display IF amplifier and detector output is passed by decoding the four-digit binary data. Wafer switches located on the shaft of the cylindrical scale of the EMC-25 act as code wheels to form a binary code, which is fed to the IF amplifier logic switching circuits. If any band between 1 and 7 is selected at the EMC-25 analyzer, the 175 KHz IF amplifier and detector output is gated to the video amplifier. If band 8, 9 or 10 is selected, the 1.6 MHz IF amplifier and detector output is gated. If any band between 11 and 15 is selected, the 8.7 MHz IF amplifier and detector output is gated.

With the DISPLAY switch in the LIN position, the video signal is fed through a video amplifier and to the oscilloscope, to provide a linear presentation.

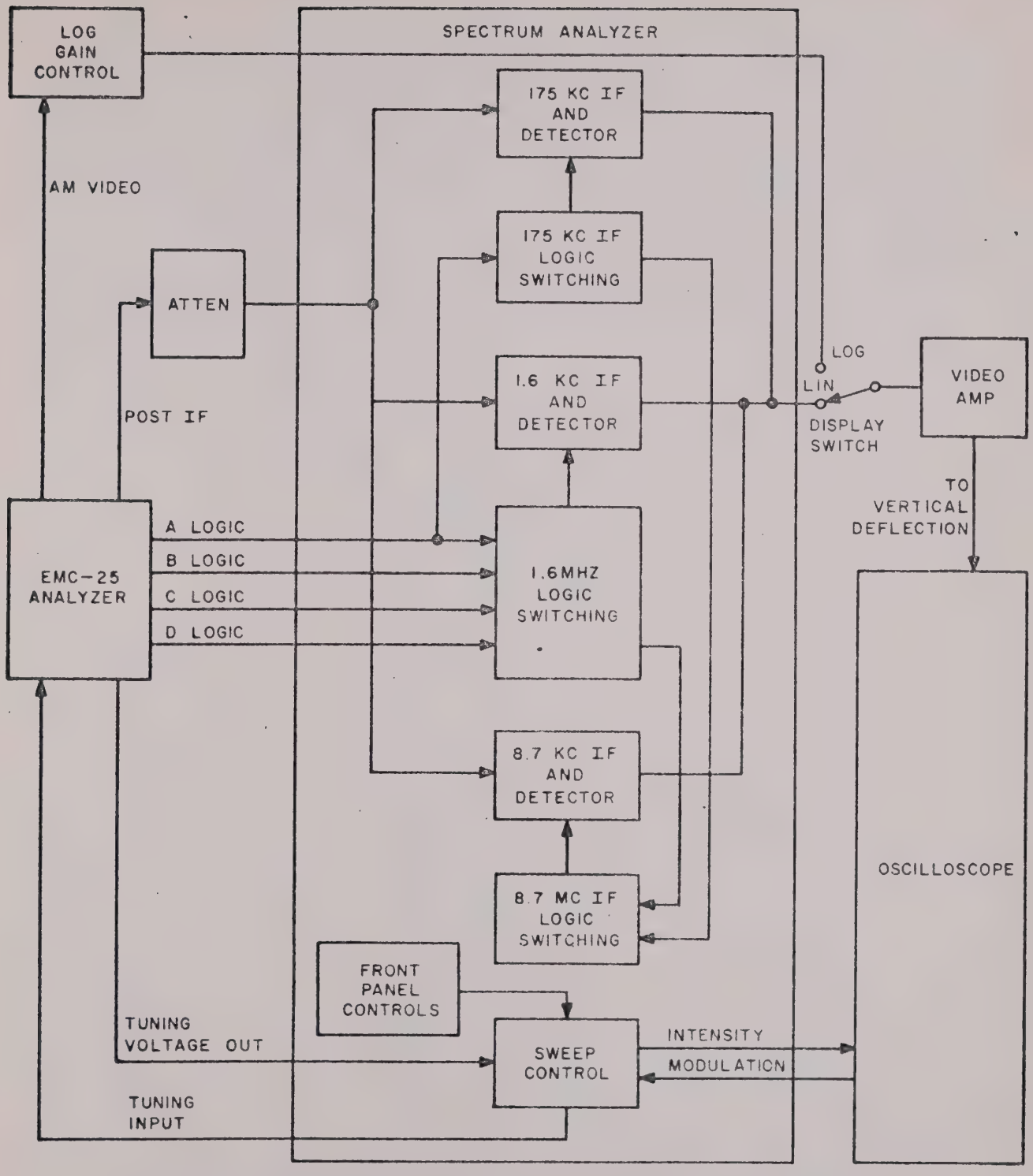


Figure 2.1 Spectrum Analyzer CSR-200, Block Diagram

The logic switching circuits operate by sensing a level of +2 to +12 VDC as a "1" or high condition, and an open circuit as a "0" or low condition. All possible combinations of levels for a four-digit binary code are shown in Table 2-1. As can be seen from the table, the 175 KHz IF amplifier output is passed whenever A is zero. The 1.6 MHz IF amplifier is selected whenever A is "1" and B is zero at the same time as either C or D is zero. The 8.7 MHz IF amplifier is selected whenever A and B are "1" simultaneously, or whenever C and D are "1" simultaneously. This is expressed in boolean terms as follows:

175 KHz	$\overline{A}$
1.6 MHz	$(A\,\overline{B})\ (\overline{C} + \overline{D})$
8.7 MHz	$(A\,B) + (C\,D)$

TABLE 2-1

BCD CODE FROM EMC-25 ANALYZER

Band	Levels A	B	C	D	IF Amp
1	0	0	0	1	
2	0	0	1	0	
3	0	0	1	1	
4	0	1	0	0	175 KHz
5	0	1	0	1	
6	0	1	1	0	
7	0	1	1	1	
8	1	0	0	0	
9	1	0	0	1	1.6 MHz
10	1	0	1	0	
11	1	0	1	1	
12	1	1	0	0	
13	1	1	0	1	8.7 MHz
14	1	1	1	0	
15	1	1	1	1	

Tuning voltage from the EMC-25 analyzer and the horizontal sweep voltage from the oscilloscope are fed to the sweep control circuit.

2.3 CIRCUIT DISCUSSION

2.3.1 175 KHz IF AMPLIFIER (Figure 5.5). The IF input on J3-21 is applied to a preset level control R9. This IF signal is capacitively coupled to the base of emitter follower Q1. The signal is then directly coupled to the base of Q2. The collector load of Q2 is a tuned circuit composed of L1-C3 and damping resistor R6, resonant to the 175 KHz input frequency. The signal from the tuned circuit is capacitive coupled to emitter follower Q3. Its output is in turn fed directly to the base of Q4. Q4 again has a tuned collector load comprised of the primary of T1 and C6 with damping resistor R8. All amplifiers (Q1-Q4) have power supply decoupling networks. Transformer T1 secondary couples the 175 KHz signal to a full-wave detector comprised of CR1 through CR4 and C12/R17 filter. The detected video signal is fed directly to the base of Q7-A. If this IF amplifier has been selected by the RF tuner setting of the EMC-25, Q7-A conducts and the amplified video is fed to the base of Q5, again amplified and presented at pin 2 as the video output.

A logic switching circuit composed of Q6, Q9 and Q8 gates the IF amplifier output through a differential feedback amplifier formed by Q7 and Q5. When the EMC-25 analyzer is set to any band between 1 and 7, pin 11 of P3 goes to a low (0) level. Switching transistor Q6 cuts off, allowing Q9 to conduct, which in turn drives Q8 into conduction. The differential amplifier composed of Q7 and Q5 then passes the detected video output to P3-2.

2.3.2 1.6 MHz IF AMPLIFIER (Figure 5.4). The IF input on J2-21 is applied to preset level control R9. The operation of the IF section including the detector is identical to the 175 KHz IF. The logic is slightly different because of the binary combinations involved. When this IF is selected, Q13 and Q12 must conduct. Q13 serves the same purpose here that Q9 does in the 175 KHz IF amplifier. In order for Q13 to conduct, both halves of Q8 must be cut off.

A logic switching circuit composed of Q6, Q9 and Q10 controls the operation of Q8-A. With a high (1) level at P2-11, transistor Q8-B is cut off. A low (0) level at P2-14 cuts off Q6. A low (0) level at either P2-15 or P2-16 (or both) holds Q9 and Q10 off, since these transistors form an AND circuit for positive inputs. With Q6, Q9 and Q10 cut off, transistor Q8-A is held to cutoff. Transistor Q13 will thus conduct, turning on Q12 and allowing the IF amplifier output to pass through the unity gain differential amplifier composed of Q11 and Q7 and to P2-2.

In case of band 11, transistors Q9 and Q10 are turned on simultaneously by +12 V on input pins 15 and 16. Q6 is turned on for band 12, 13, 14 and 15. These inhibit conditions place the junction of R18 and R20 at ground. This places the base of Q8-A slightly negative causing it to conduct. This in turn cuts off Q13, inhibiting this IF amplifier. During selection of bands 1-7, Q8-B conducts, likewise cutting off Q13, inhibiting this IF amplifier.

2.3.3 8.7 MHz IF AMPLIFIER (Figure 5.3). The IF input on J1-21 is applied to a preset level control R9. The operation of the IF section including the detector is identical to the 175 KHz IF. The logic is slightly different in that selection of this IF amplifier depends on the 175 KHz and the 1.6 MHz IF amplifiers being inhibited. The inputs on pins 12 and 13 originate from pins 12 of A1A2 and 13 of A1A3 respectively. If either A1A2 or A1A3 are inhibited these sources will be a positive level. Whenever both are inhibited, these positive levels will be fed to the bases of Q6-A and Q6-B, causing each to cut off. Transistor Q9 will thus conduct, turning on Q12 and allowing the IF amplifier output to pass through the unity gain differential amplifier composed of Q11 and Q7 to P1-2.

The outputs of all three IF amplifiers (pin 2) are physically wired together. This is permitted since only one at a time is selected.

2.3.4 VIDEO AMPLIFIER (Figure 5.7). The input to the video amplifier is from one to two sources; from the common output point of the three IF amplifiers, or the amplitude modulated video from the EMC-25. The video input is applied to the base of Q1-A. Voltage dividers R31/32 and R34/33 place a potential difference of approximately 150 MV between pins 6 and 7. The video position control is connected between pins 6 and 7, the center tap being connected to the base of Q1-B by way of pin 4.

The amplitude variance of the video input to Q1-A causes the current through R2 to vary. This output from Q1-A is fed to the base of Q2-A. The output at the emitter of Q1-B places the base of Q2-B at a fixed potential. The current variation through R4 is caused by the signal at the base of Q2-A. The resulting voltage variation at the emitter of Q2-A is coupled through R6 to the emitter of Q2-B, effecting a drive to Q2-B base that is 180° out of phase with the video to the base of Q2-A. Amplified, out of phase video, is present at the collectors of Q2-A and Q2-B. These signals are fed to push-pull amplifiers Q3 and Q4. The amplified push-pull video signals at the collectors of Q3 and Q4 are fed to pins 21 and 15. These pins connect directly to the vertical deflection plates of the SPD-125 Porta Scope. Video gain pot R14 controls the gain of the video amplifier to the vertical deflection plates of the scope. Capacitors C3 and C4 are factory selected to provide the correct amount of positive feedback across the push-pull output to increase high frequency response of the amplifier.

Potentiometer R22 picks off a selected amount of the video output and delivers it to pin 19. R26 is adjusted for the proper bias level for this signal. A synchronizing signal for the model 7414 time base is delivered to pin 20 through a network consisting of R24, R25 and C6.

2.3.5 SWEEP CONTROL (Figure 5.6). The function of the sweep control assembly is determined by the setting of the four-position function switch (A1S1) located on the front panel. A sawtooth sweep voltage

originating in the model 7414 time base plug-in unit of the scope is applied to pin 32 of J9001. This sweep voltage is presented to pin 4 of the sweep control (A4) as an input. The sweep voltage required to sweep the EMC-25 analyzer through the band always starts at 0 volt at the low end of the band and goes to 1.3 volt at the high end of the band.

2.3.5.1 FUNCTION SWITCH SETTINGS

2.3.5.1.1 SPECTRUM AND LOCATOR POSITIONS. The sawtooth sweep voltage input is fed to a voltage divider composed of R37, R36 and R35. R32 (spectrum LF adj.) adjusts the start of the sweep voltage, and thus the low frequency end of the spectrum being analyzed. R31, R32, and R33 form a voltage divider between +50 V and -50 V. Adjustment of R32 varies the polarity and amplitude of voltage at the junction of R37 and R36. This provides the required DC offset voltage to the incoming sawtooth voltage to provide a 0 V input at the EMC-25 to begin the sweep at the low end of the band. A portion of the sawtooth voltage is picked off at the center tap of R36 and fed to S1B-1, 2. In this switch position, this sawtooth voltage is fed to J6-C as a tuning voltage to the EMC-25 Interference Analyzer. Amplitude adjustment of R36 provides the correct setting for the high frequency end of the spectrum. This adjustment provides the proper voltage for scanning the entire band.

2.3.5.1.2 SIGNATURE POSITION (Figure 2.2). This setting of the function switch allows the sawtooth voltage from the SPD-125 Porta Scope to be superimposed upon the tuning voltage from the EMC-25. The sweep voltage is fed in at pin 4 through R24 to junction of R23 and R19. The signature symmetry control (R26) adds a DC offset such that the sawtooth voltage varies equally positive and negative around the EMC-25 tuning voltage. This tuning voltage is fed to a operational amplifier composed of Q7, Q8 and Q10. R30 is a balance adjustment

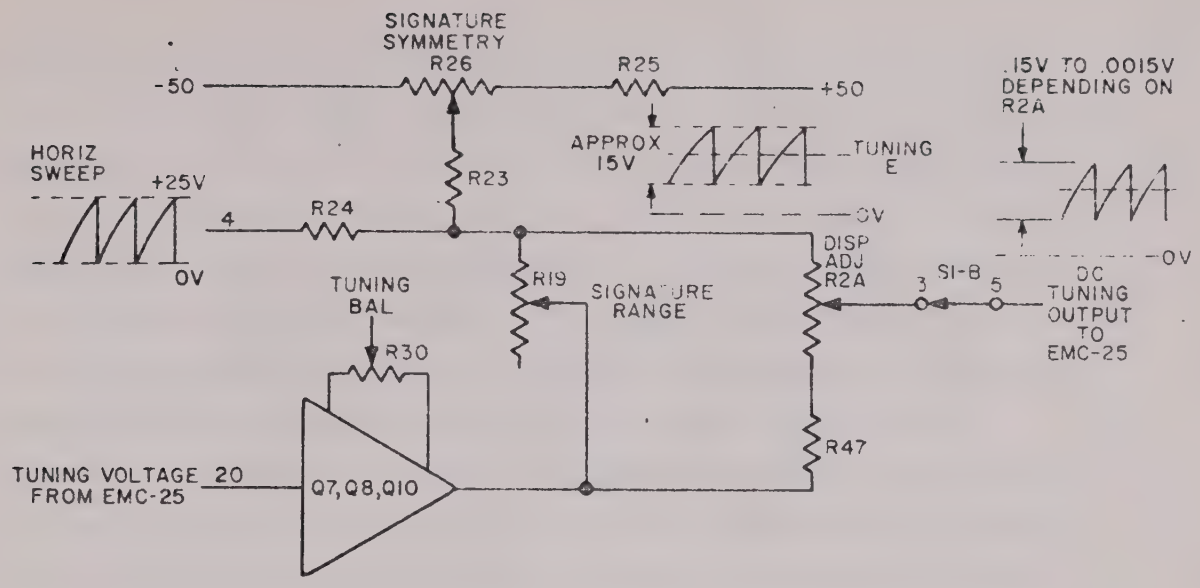


Figure 2.2 Function Switch Setting, Signature

for Q10-A and Q10-B. The signature range control (R19) varies the level of the superimposed sawtooth voltage. When these controls are properly adjusted, the dispersion control (R2A) will vary the superimposed sawtooth from 0.15 V (nominal) to 0.0015 V (nominal) without changing the DC tuning set by the EMC-25 tuning dial position. With the switch in this position, the tuning control on the EMC-10 determines the center of the sweep. The width of the sweep from 10% of a band to 0.1% of a band is determined by the dispersion control on the oscilloscope.

2.3.5.1.3 VIDEO POSITION. In the video position the tuning voltage input bypasses the sweep control by way of S1B-4, and is fed directly from J6-A to J6-C as tuning E output to the EMC-25. In this position, the analyzer is not being scanned in frequency but is tuned to the frequency set by each frequency control. Video, therefore, is displayed as a function of time only.

2.3.5.1.4 BRIGHT-UP CIRCUIT (Figure 2.3). The sawtooth voltage from the Model 7414 Time Base plug-in unit in the SPD-125 Porta Scope is fed to pin 4. From the center tap of R36 it is fed through C1-R20 coupling to the base of transistor Q1-A. The tuning voltage from the EMC-25 is fed to a low output impedance, unity gain operational amplifier composed of Q7, Q8 and Q10. The input to this amplifier is controlled by the amount of feedback voltage from the voltage divider containing R2B (Disp Control), R46 (Locator, Narrow Adj) and R17 (Locator, Wide Adj). The slope of the amplified sawtooth waveform at the collector of Q2 is varied by the previously mentioned adjustments. These adjustments also control the gain of the operational amplifier. Since the feedback voltage divider is returned to the operational amplifier output, the average DC level at the collector of Q2 is varied by the tuning voltage, that is by the position of the EMC-25 tuning dial. Either Q3 or Q4 will conduct when the potential at the collector of Q2 is either positive or negative respectively as compared to the tuning voltage output from the operational amplifier. Whenever either Q3 or Q4 conducts, the base of Q6 will be driven positive causing it to conduct. The resulting drop across R29 will cause the potential on the brightness gating plate in the Scope to decrease. As a result the trace presented will be dimmed.

The amount of conduction of Q6 depends on setting of A1R5 (Contrast). Q3 or Q4 must have a forward bias of 0.4 volt or more before they will conduct. Because of this neither Q3 nor Q4 conducts when the voltage at the collector of Q2 varies between -0.4 V and +0.4 V with respect to the operational amplifier output. The voltage at the collector of Q2 varies from a negative to a positive value during the period of each sweep. During the interval of the sweep when Q3 and Q4 are cut off, the voltage on the brightness gating plate in the Scope will increase to the value on the collector of Q6 (X-plug-in blanking). This will cause that portion of the trace to brighten. The point on the sawtooth voltage where Q3 and Q4 are both cut off is determined by the tuning voltage output from the

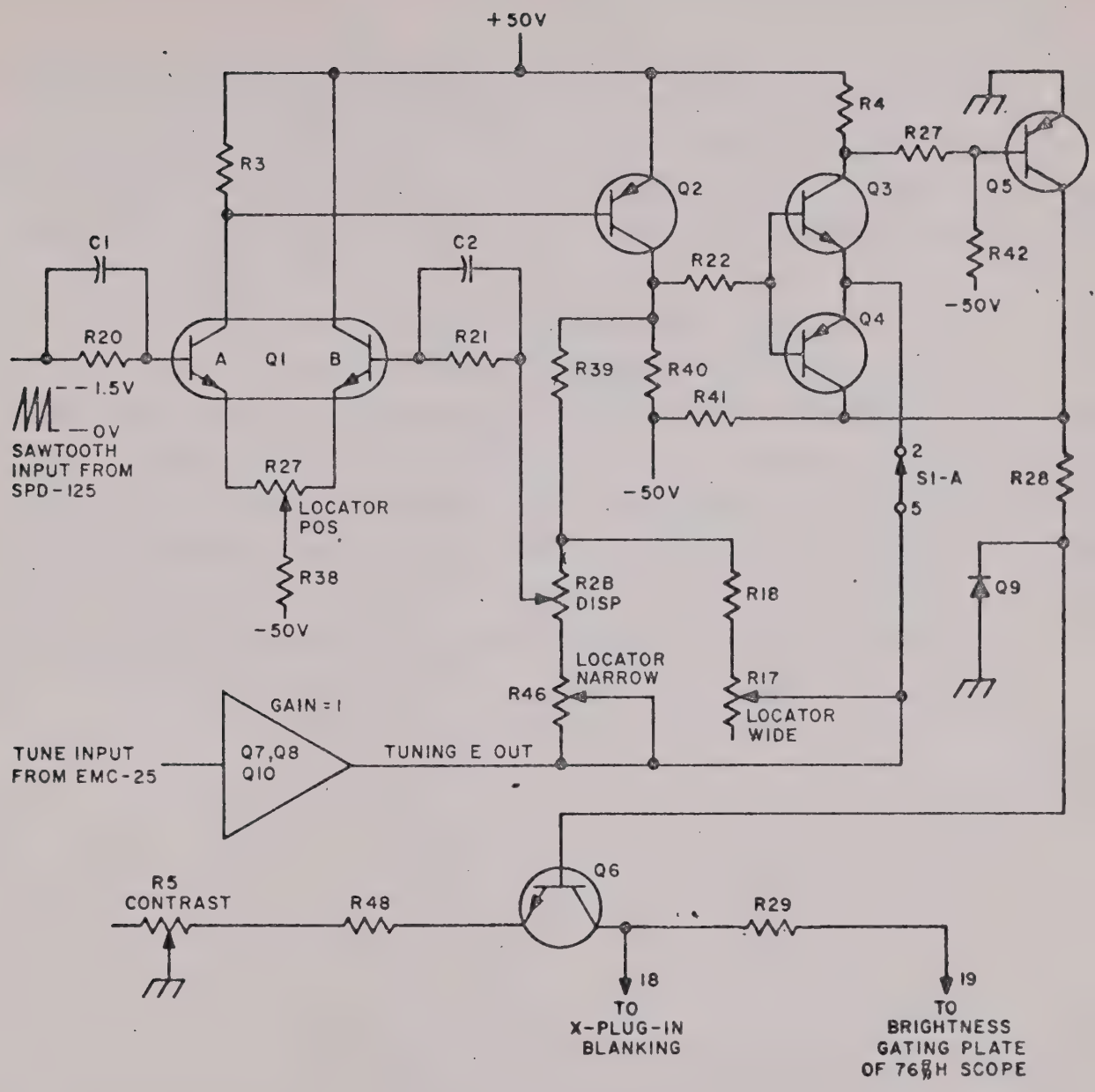


Figure 2.3 Bright-Up Circuit, Simplified Diagram

operational amplifier. Therefore as the tuning dial on the EMC-25 is varied, the tuning voltage will vary, causing the brightened portion of the sweep to move along the trace. The amount of time that Q3 and Q4 are cut off is determined by the slope of the sawtooth voltage at the collector of Q2. When the arm of R2B (Disp) is moved closer to R46 (CCW),

the gain of the operational amplifier is increased causing the slope of the sawtooth to increase. Q3 and Q4 cut-off time decreases causing the intensified portion of the trace to narrow. Adjustment of R2B in the opposite direction will reverse conditions, causing the intensified portion of the trace to widen.

R46 (Locator, Narrow Adj) affects the maximum gain of the operational amplifier, setting the minimum feedback level. This control is used to adjust the narrowest intensified portion of the sweep. R17 (Locator, Wide Adj) affects the minimum gain of the operational amplifier, setting the maximum feedback level. This control is used to adjust the widest intensified portion of the sweep. R27 (Locator-Position), connected between the emitters of Q1 adjusts the DC balance between Q1-A and Q1-B. It is therefore used to adjust the intensified portion of the sweep to the desired position for a given tuning voltage.

SECTION III

OPERATION INSTRUCTIONS

3.1 GENERAL

3.1.1 This section provides instructions for operation of the Spectrum Display PP-125 as a plug-in unit for the Fairchild 767-H Scope when used in conjunction with the Interference Analyzer, Model EMC-25. These three items together with connecting cables comprise the Spectrum Analyzer CSR-200. Instructions are also included for pre-operating calibration and checkout.

3.2 UNPACKING

3.2.1 Remove the instrument carefully from the shipping carton and examine thoroughly for shipping damage. If there is any damage, replace the instrument in the shipping carton and immediately inform the manufacturer and the shipping company of the nature of the damage, the serial number of the instrument, the delivery date, and the invoice number.

3.2.2 Check contents of carton against shipping list to be sure all items ordered are present. Notify the manufacturer immediately of any missing items.

3.3 ELECTRONIC SHIPPING DAMAGE

3.3.1 Before leaving the factory, this instrument was subjected to a complete operational check. However, it is possible that electronic damage may have occurred in transit. It is desirable, therefore, to check the operation of the instrument as soon as possible after unpackaging.

To do so, check the overall operation of the instrument as outlined in paragraph 3.7. If the instrument does not perform using the referenced procedure, inform the manufacturer giving the basic information required in paragraph 3.2.1.

3.4 INSTALLATION

The Spectrum Display PP-125 is designed to operate as a Y-plug-in for the Fairchild 767-H Scope. To install this instrument into the SPD-125 scope, carefully insert into the cavity provided for the Y input plug-in unit. Care must be taken to insure proper mating between J9001 and P9001. Firmly press unit in place until the front panel is flush. Tighten the knurled knob at the bottom center until tight.

3.4.1 ELECTRICAL INSTALLATION

3.4.1.1 Connect the short BNC cable provided between the AM VIDEO connection on the front panel of the EMC-25 receiver and the AM VIDEO connection on the front panel of the PP-125 scope plug-in.

3.4.1.2 Connect the long BNC cable provided between the POST IF output connector on the rear of the EMC-25 and the POST IF connector on the front panel of the PP-125.

3.4.1.3 Connect the multi-conductor cable provided between the REMOTE connector on the EMC-25 front panel and the multi-pin connector on the front panel of the EMC-25. The remote cable is secured to its respective connectors with two thumb screws which must be evenly tightened after alignment of the mated connectors is completed.

CAUTION

The EMC-25 should be turned OFF while making the remote cable connections.

3.4.1.4 If the PP-125 Spectrum Display is to be used with a 767-H oscilloscope which has not been mated to it at the factory, modify the existing scope circuitry as shown in Figure 3.1.

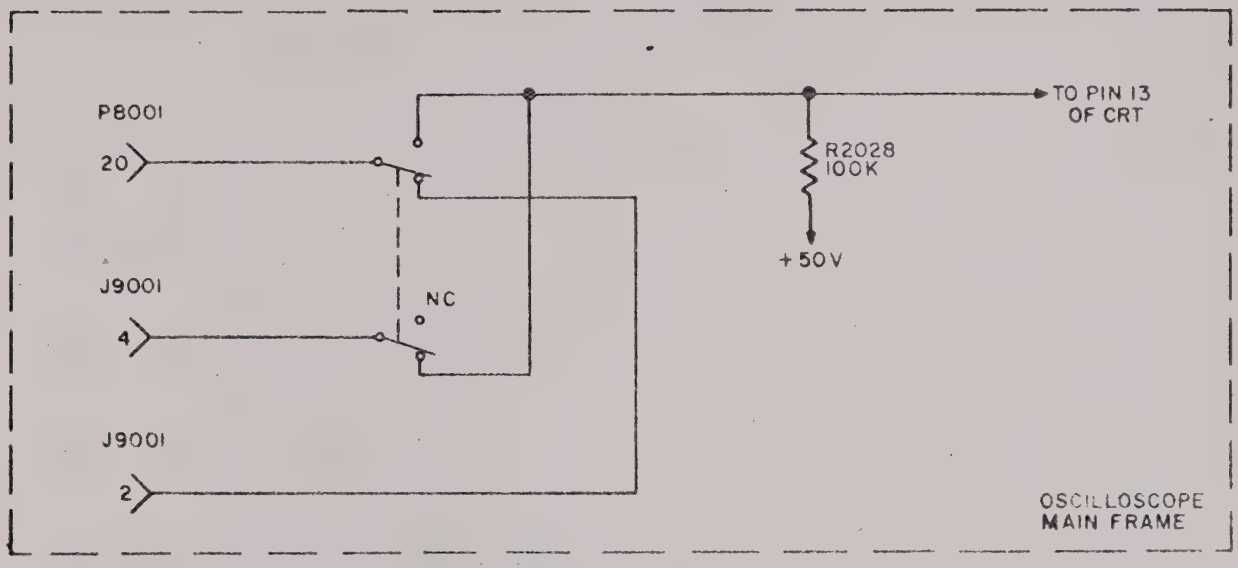


Figure 3.1 Oscilloscope Main Frame Modification - Switch in SPD Position

3.4.1.5 Using the power cords provided, connect both the EMC-25 and the SPD-125 to a power source of 125 V, 60 Hz, AC.

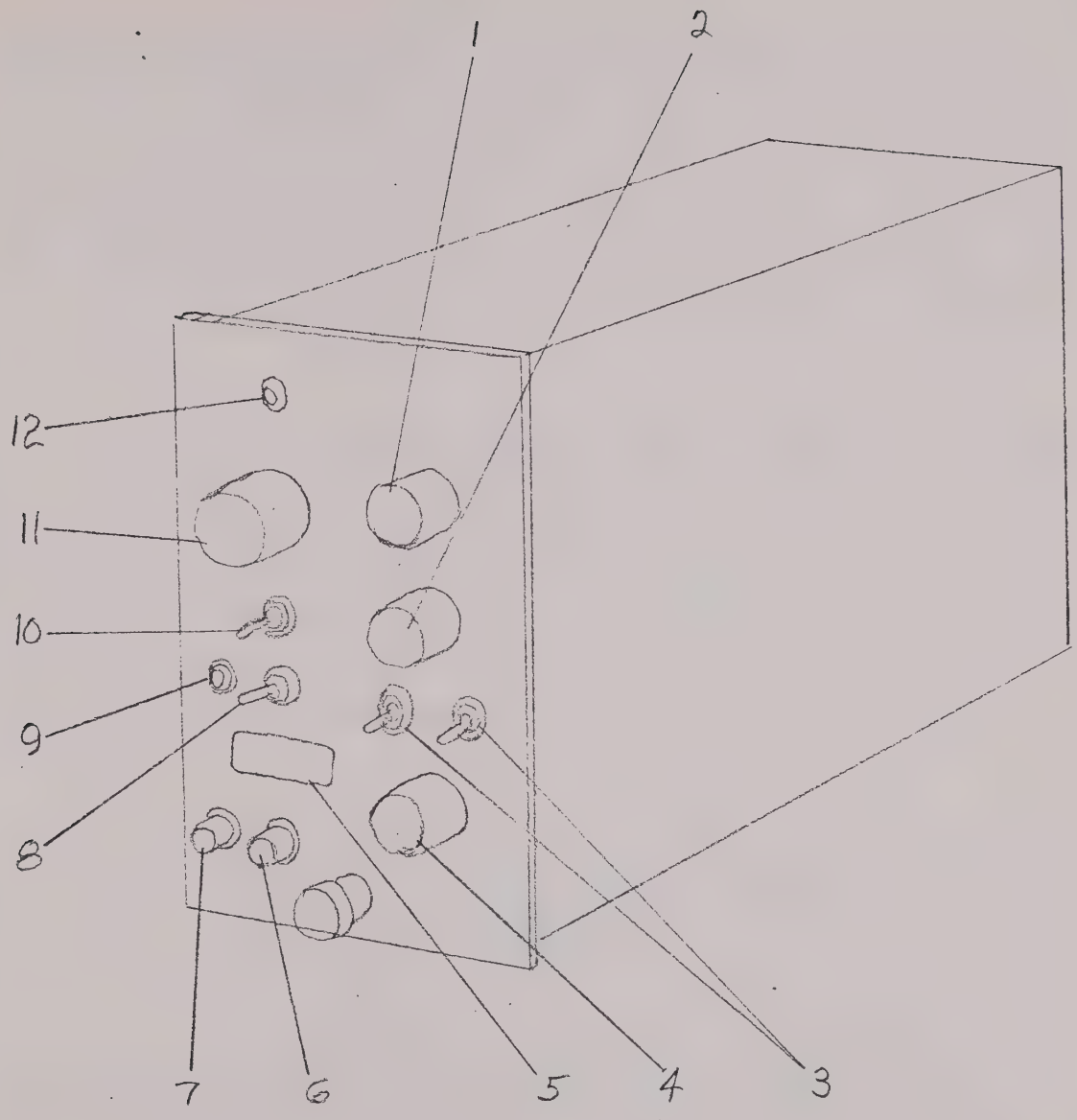
3.4.1.6 If the individual components have not been previously checked out as a system, the calibration adjustments outlined in Section 4.4 should be performed before the system is placed in operation.

3.4.1.7 The EMC-25 Instruction Manual and the sections of this manual pertaining to the SPD-125 scope frame give mechanical and electrical installation instructions for the other individual units of the system.

3.5 CONTROL FUNCTIONS (Figure 3.2)

3.5.1 FUNCTION SWITCH

3.5.1.1 SPECTRUM POSITION. In this position the correctly adjusted CSR-200 system will display a swept frequency spectrum on the scope which covers an entire tuning band of the EMC-25 receiver.



1. CONTRAST (A1R5)
2. POSITION (A1R3)
3. DISPERSION (A1R2)
4. ATTENUATORS (A1S2, A1S3)
5. ATTEN (A1R17)
6. INPUT CONNECTOR (A1J6)
7. POST IF (A1J7)
8. AM VIDEO (A1J8)
9. DISPLAY (A1S4)
10. LOG GAIN (A1R18)
11. VIDEO FILTER (A1S5)
12. FUNCTION (A1S1)

Figure 3.2 Spectrum Display PP-125, Front Panel Controls and Adjustments

3.5.1.2 LOCATOR POSITION. With the function switch in this position the display is the same as in the spectrum position except that a brightened-up section of the scope trace indicates the portion of the band which will be displayed when the function switch is advanced to signature. The position of the brightened-up section of the trace is varied by the EMC tuning control and the width of this brightened-up section is varied by the DISPERSION control.

3.5.1.3 SIGNATURE POSITION. With the function switch in this position, a small portion of an EMC-25 frequency band is displayed as a swept frequency spectrum. The frequency range swept can be varied from 10% to 0.1% of an EMC-25 band by variation of the DISPERSION control. The center frequency of this expanded sweep is determined by the position of the EMC-25 tuning control, and may be read on the EMC-25 tuning dial.

3.5.1.4 VIDEO POSITION. With the switch in this position, the frequency is not swept. The scope display will consist of an AM detected time-based display of any signal tuned in on the EMC-25.

3.5.2 CONTRAST CONTROL. This is a screwdriver adjustment located on the front panel of the PP-125. With the function switch in locator position, it controls the difference in brightness level between the scope trace and the brightened locator indicator appearing on the trace. This adjustment has no effect except in the locator position of the function switch.

3.5.3 POSITION SWITCH. This switch provides vertical positioning of the scope trace. For normal operation the trace should be positioned to coincide with the bottom line of the scope graticule. This adjustment should be made with the DISPLAY switch in LIN position and with no

signal input. When viewing time-based modulated waveforms in the video position of the function switch it may be convenient to adjust the positioning control to position the pattern towards the center of the scope.

3.5.4 DISPERSION CONTROL. This front panel control varies the portion of the EMC-25 band swept from 10% to 0.1% of the band with the function switch in SIGNATURE position. In the LOCATOR position, this portion of the full band sweep is illuminated by a brightened-up trace section. The width of this brightened section is varied by the position of the DISPERSION control to indicate the band-segment to be swept when the function switch is in the SIGNATURE position.

3.5.5 VIDEO FILTER. In the ON position of this switch, a low-pass filter is inserted to decrease noise and interference on the scope.

3.5.6 DISPLAY (LOG/LIN)

3.5.6.1 In the LOG position, a logarithmically compressed DC coupled display of the video information is presented on the scope. This allows for a full 60 DB dynamic range to be presented while allowing simultaneous observation of both low and high amplitude signals. The right-hand markings of the scope graticule are the calibration indicators for this display and correspond to the EMC-25 indicator meter markings. The scope display is therefore an instantaneous dynamic presentation of the static EMC-25 meter reading. When using the swept frequency functions, the amplitude of any and all responses presented on the scope may be determined directly in DB/uV by the graticule markings.

3.5.6.2 In the LIN position of the DISPLAY switch the scope presentation is linear in respect to amplitude permitting observation of responses in their true linear relationship, without distortion or compression. To provide the same 60 DB dynamic range in this display as in LOG, two

20 DB attenuator switches and a variable attenuator control are provided on the front panel. The left-hand markings of the scope graticule are used in this display position, and calibration is in percent.

3.5.7 LOG GAIN CONTROL. This control is a screwdriver adjustment on the front panel of the PP-125 used to calibrate the LOG display of the scope to the EMC-25 meter reading.

3.5.8 0 - 20 DB SWITCHES. These switches provide 0, 20, and 40 DB attenuation of the signal in the LIN display mode. Through their use, any on-scale response in the LOG display mode may be presented as a linear display. With both attenuators switched to 20 DB, a +20 DB response in the LOG display mode would produce a 100% response (5 cm) in the LIN display mode. Under these conditions, a -20 DB response in the LOG display mode would not be visible in the LIN mode. However, switching the attenuator switches to give 0 DB attenuation would produce 100% deflection.

3.5.9 ATTENUATOR CONTROL. This control is used to adjust the display in linear display mode to any desired level. For a calibrated display it is kept fully clockwise.

3.5.10 REMOTE CONNECTOR (J6). All the remote bandswitching and remote tuning information for the systems operation passes through this cable, connected between the EMC-25 and this input to the PP-125.

3.5.11 AM VIDEO (J8). The DC coupled, logarithmically detected output of the EMC-25 is fed into this input through a coaxial cable. In the LOG display mode, this signal (after amplification) is used for the vertical deflection of the scope.

3.5.12 POST IF (J7). This input couples the IF output of the EMC-25 to the PP-125 by means of a coaxial cable. In the LIN display mode, this IF signal is amplified and linearly detected or used for the vertical deflection.

3.5.13 SPD NORMAL SWITCH. This switch is located in the main frame of the SPD-125. It is accessible by removing the bottom cover of the SPD and is located on a plate underneath the CRT. Its function is to allow intensity modulation of the CRT by the PP-125 plug-in. It must be in the SPD position when used in conjunction with the PP-125, but must be in normal position when using conventional Y plug-ins. If the scope frame has not been furnished specifically for use with the PP-125, this switch must be added (see Figure 3.1). Installation kits are available from Fairchild. The circuit changes affected by the switch are as shown in Figure 3.1.

3.6 OPERATIONAL PRECAUTIONS

3.6.1 CONNECTORS. Normal operation can be achieved only after Spectrum Display PP-125 has been placed in the Y input cavity of the SPD-125 Porta Scope and POST IF (J7), AM VIDEO (J8) and INPUT CONNECTOR (J6) have been properly connected to cables leading to corresponding connectors on the Interference Analyzer, Model EMC-25.

3.6.2 ADJUSTMENTS. Several adjustments (potentiometers) exist on the sweep control board (A1A4) and the video amplifier (A1A5), and one input level control on each IF amplifier (A1A1-A1A3). If this instrument is shipped as a part of Spectrum Analyzer CSR-200, these adjustments will have been preset at the factory and further adjustments will not be necessary. In the event this instrument is purchased separately to supplement already existing equipment, or is to be used in place of

another PP-125 in a different CSR-200 system, the adjustment of these potentiometers must be completed. Reference should be made to the Service and Maintenance Section for specific procedures given to accomplish this.

3.7 OPERATION PROCEDURE

3.7.1 Following is a brief description of the displays to be presented and the interpretation of these displays.

3.7.2 INITIAL CONTROL SETTINGS (Table 3-1)

3.7.3 RESPONSE AMPLITUDE - LOG Display.

3.7.3.1 AMPLITUDE. Calibrate the EMC-25 as described in the EMC-25 Instruction Manual.

3.7.3.2 Set the PP-125 DISPLAY switch to LIN, and adjust the POSITION control until the base line of the scope trace corresponds to the bottom line of the scope graticule. This adjustment should always be done in LIN. Return the DISPLAY switch to LOG.

3.7.3.3 The display should consist of a bright horizontal trace along the bottom section of the graticule with a single response spike of approximately full-scale deflection at about the center of the screen. This response is caused by the signal generator input. Its response is full scale because:

a. The signal amplitude (+100 uV) is +40 DB/uV.
b. The top line of the scope graticule is +20 DB/uV.
c. The ATTENUATOR setting of the EMC-25 in the CAL position is 20 DB.

TABLE 3-1

INITIAL CONTROL SETTINGS

EMC-25

Control	Setting
ATTENUATOR	CAL
BANDWIDTH	WIDE
BAND SWITCH	60 - 120 KHz
FREQUENCY	80 KHz

PP-125

Function	Spectrum
VIDEO FILTER	Off
DISPLAY	LOG
DISPERSION	Fully clockwise
POSITION	As noted
Attenuator Switches	Both 20 DB
Attenuator Control	Fully Clockwise

SPD-125

SWEEP SPEED	50 Ms/cm

Other scope controls adjusted to provide a bright, sharp trace on the scope.

EMC-25 INPUT

80 KHz 100 uV unmodulated CW signal from a calibrated signal generator.

3.7.3.4 Increase the signal generator output to 1000 uV (+60 DB/uV), and turn the EMC-25 ATTENUATOR control to its 40 DB position. The signal generator output is indicated by the 40 DB setting of the EMC-25 attenuator and the +20 DB (full scale) deflection caused by the signal generator.

3.7.3.5 Decrease the signal generator output to 10 uV (20 DB/uV). The amplitude of the response caused by the signal generator should have decreased to the -20 DB line of the scope graticule (+20 DB/uV = +40 DB (EMC-25 attenuator) -20 DB (scan deflection).

3.7.4 RESPONSE AMPLITUDE LIN POSITION

3.7.4.1 Return the signal generator output to 100 uV (+40 DB/uV) and return the EMC-25 attenuator to 20 DB (CAL). Switch the DISPLAY switch to LIN. The response caused by the generator should correspond in amplitude to the 100% markings on the left-hand side of the graticule. Reduce the signal generator output to 50 uV (+34 DB/uV) and the amplitude of the response curve will have decreased to the 50% markings of the scope graticule.

3.7.4.2 Reduce the signal generator signal to 10 uV (20 DB/uV). Note that the signal generator response on the scope is barely visible. Turn one of the 20 DB switches on the PP-125 to its 0 DB position and the response due to the input signal will reach an amplitude corresponding to the 100% markings of the graticule.

3.7.5 RESPONSE FREQUENCY

3.7.5.1 Return the equipment settings to those described in the initial settings table (Table 4-3) so that the scope response is the same as that presented in paragraph 3.7.2.3. Turn the function switch of the PP-125

to LOCATOR. A section of the horizontal sweep about 1 cm long in the signal generator response should now be brighter than the rest of the sweep. The CONTRAST control, a screwdriver adjustment on the front panel of the PP-125, may be adjusted to vary the difference in brightness.

3.7.5.2 Turn the DISPERSION control fully counterclockwise, and the brightened-up section of the sweep will be reduced in width until it appears as a point.

3.7.5.3 Vary the TUNING control of the EMC-25 and note that the brightened dot on the scope moves in response to this tuning. Move the TUNING control until the brightened dot is at the very top of the response caused by the signal generator. Note the setting of the EMC-25 tuning indicator dial. This setting will be the same frequency as the input signal. The frequency of any scope response can be determined in this manner.

3.7.6 SIGNATURE RESPONSE (EXPANDED RESPONSE)

3.7.6.1 With the settings as above, turn the DISPERSION control fully clockwise so that the trace is again brightened for about 1 cm of its length.

3.7.6.2 Turn the function switch of the PP-125 to the SIGNATURE position. The display presented on the scope is a horizontally expanded response including only the frequency band illuminated by the brightened sweep sector in locator (about 10% of the EMC-25 band). The signal response here noted is a logarithmically compressed picture of the frequency response of the system.

3.7.6.3 If the DISPLAY switch is thrown to LIN, the resultant display is a linear graph of the system bandwidth.

3.7.6.4 Turn the bandwidth switch of the EMC-25 to narrow, and note that the response pattern narrows.

Amplitude modulate the signal fed into the EMC-25 and note that this modulation is visible on the envelope of the scope response. Vary the percent of modulation and the frequency of modulation and note that much can be determined about the nature of signal modulation by the scope presentation. An FM modulated signal can also be identified and analyzed by its scope pattern, as can a pulse modulated signal.

With the DISPLAY switch in LIN, and the BANDWIDTH switch of the EMC-25 in NARROW, vary the DISPERSION control of the PP-125. Note that the scope response pattern becomes more and more expanded horizontally as the control is turned clockwise, indicating a narrower frequency sweep. The band of frequencies swept is varied from 10 percent of the EMC-25 band with the DISPERSION control fully counter-clockwise, to 0.1% of the EMC-25 band with the control turned fully clockwise.

It will be noted that adjustment of the EMC-25 tuning dial causes the response to move rapidly across the scope. The center frequency being swept is set by the position of the EMC-25 tuning dial. The band of frequencies swept is varied by the position of the DISPERSION control, and is visually presented by the brightened up sweep section in LOCATOR position of the function switch.

3.8 VIDEO RECEPTION

3.8.1 In the VIDEO position of the function switch, the EMC-25 is fix-tuned at the frequency indicated by the EMC-25 tuning dial. The scope response is a time-based display of any signal tuned in on the EMC-25.

The amplitude and modulation of such a signal can be quantitively investigated in this position.

3.9 HORIZONTAL SWEEP SPEED LIMITATIONS

The maximum sweep speed usable is determined by the relationship between the bandwidth of the receiver, and the rate of change of frequency. The receiver bandwidth is dependent on the EMC-25 band being used and the position of the EMC-25 bandwidth switch. The Δf (rate of change of frequency) is determined by the EMC-25 band setting, and the function switch setting of the PP-125. Because of these many variables no one maximum sweep speed can be stated.

In general, the slowest sweep presenting a continuous picture should be used for initial scanning of a band. When a response is detected, the sweep speed may be increased until some decrease in the responses amplitude is noted, then decreased until the amplitude returns to normal.

Much higher sweep speeds may be used in SIGNATURE position than are possible in LOCATOR or SPECTRUM positions, as only a small portion of the band is being scanned.

If a change in response amplitude is noted when EMC-25 bandwidth switch is changed or when the function switch, or DISPERSION control of the PP-125 is changed, the sweep speed should be decreased.

If the response amplitude changes when sweep speed is changed, the horizontal sweep speed is set too high.

Low frequency pulsed signals or intermittent signals may be investigated on a scope camera using a very slow sweep speed.

SECTION IV

SERVICE AND MAINTENANCE

4.1 GENERAL

4.1.1 This section includes material necessary for the maintenance and repair of the Spectrum Display PP-125. Repair should be attempted only by individuals familiar with the theory of operation of the PP-125. All maintenance will be performed using the PP-125 with the EMC-25 and the SPD-125 Porta Scope.

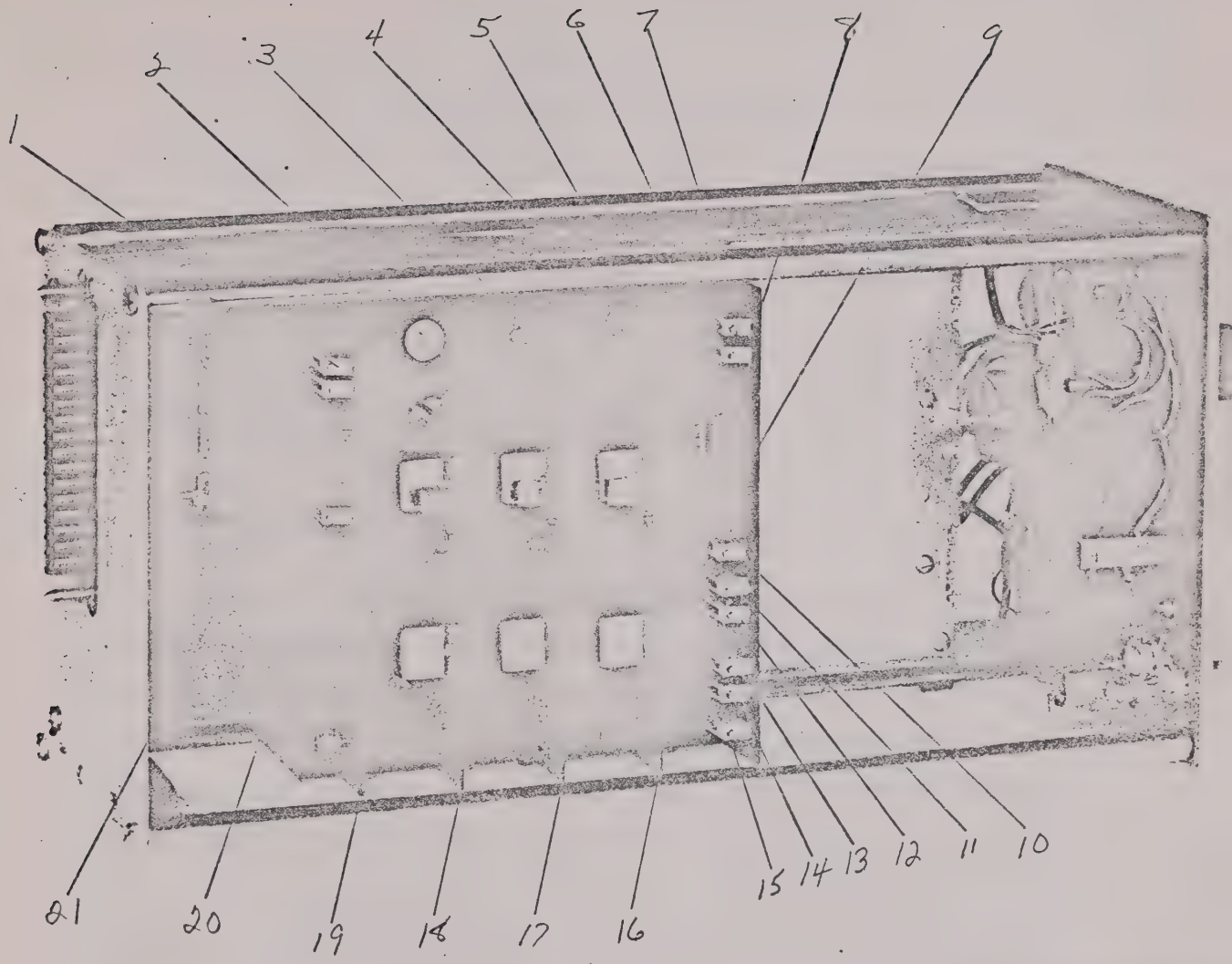
CAUTION

Readjustment of almost any internal control can invalidate calibrations performed that makes this instrument compatible with a given Interference Analyzer, EMC-25 and SPD-125 Porta Scope. All plug-in cards, A1A1 through A1A5, contain one or more adjustments.

4.2 REPLACEMENT OF ASSEMBLIES

4.2.1 Replacement of assemblies can be accomplished only after the Spectrum Display PP-125 has been removed from the SPD-125 Porta Scope. To remove the PP-125 from the SPD-125 Porta Scope, unscrew the knurled knob at the bottom center of the unit. After the knob is completely loose, pull the PP-125 straight out until it is completely detached from the SPD-125. Connecting cables are not used internally between the PP-125 and the SPD-125 Porta Scope.

4.2.2 Individual assemblies (A1A1 through A1A5) may now be removed from the PP-125 main chassis in a conventional fashion. Figure 4.1 shows the physical location of all plug-in assemblies. Table 4-1 lists the plug-in assembly by name, nomenclature and location.



1. R22, Y Output Gain Control
2. R9, 8.7 MHz IF Gain Control
3. R9, 1.6 MHz IF Gain Control
4. R9, 175 KHz IF Gain Control
5. R30, Tuning Balance Control
6. R17, Locator Width Control (wide)
7. R46, Locator Width Control (narrow)
8. Sweep Control Board A1A4
9. R27, Locator Position Control
10. R9, X Output Zero Adjust Control
11. R1, X Output Gain Control
12. R19, Signature Range Control
13. R26, Signature Symmetry Control
14. R32, Spectrum LF Adjust Control
15. R36, Spectrum HF Adjust Control
16. 175 KHz IF Amplifier Board A1A3
17. 1.6 MHz IF Amplifier Board A1A2
18. 8.7 MHz IF Amplifier Board A1A1
19. Video Amplifier Board A1
20. R14, Video Gain Control
21. R26, Y Output Zero Adjust Control

Figure 4.1 Replaceable Assemblies with Calibration Adjustments

TABLE 4-1

REPLACEABLE ASSEMBLIES

NAME	NOMENCLATURE	LOCATION
8.7 MHz IF Amplifier	A1A1	Figure 4.1
1.6 MHz IF Amplifier	A1A2	Figure 4.1
175 KHz IF Amplifier	A1A3	Figure 4.1
Sweep Control	A1A4	Figure 4.1
Video Amplifier	A1A5	Figure 4.1

4.3 PERIODIC SERVICE

4.3.1 Thus unit is a stable instrument that will provide many hours of trouble-free operation. Since this instrument is a plug-in unit for the 767-H Scope, it should be given the same periodic check. It is suggested that this instrument be calibrated after each 500 hours of operation or every six months if used intermittently. Also the calibration should always be checked and adjusted after the repair and/or replacement of any component part on one of the individual assemblies or main chassis. Complete adjustments and calibration procedures are given in this section.

NOTE

The regulated power supplies on the main frame of the Scope should always be checked before calibration of this instrument.

4.4 TEST EQUIPMENT REQUIRED FOR CALIBRATION AND ADJUSTMENTS

4.4.1 Adjustments outlined in Section 4.5 are based on test procedures followed at the factory. Table 4-2 lists the test equipment required to complete the adjustments and calibrations for operation with the scope.

TABLE 4-2

TEST EQUIPMENT REQUIRED

EQUIPMENT	DESCRIPTION
Signal Generator (14 KHz - 10 MHz)	Hewlett-Packard, HP651 or equivalent
Signal Generator (10 MHz - 500 MHz)	Hewlett-Packard, HP608 or equivalent
Interference Analyzer	Fairchild, Electro Metrics, EMC-25
Oscilloscope	Fairchild, Porta Scope, 767-H with Time Base plug-in unit, type 74-13A
Voltmeter	Simpson 260 or equivalent
Connecting Cables (supplied)	2 coaxial cables for connection between AM VIDEO and POST IF connections
	1 multiwire cable for connection between remote connectors
Extender Cable	1 multiwire cable to allow Spectrum Display PP-125 to be connected to external 767-H scope
Oscilloscope	Any readily available bench instrument

4.5 SPECTRUM DISPLAY PP-125 CALIBRATION AND ADJUSTMENTS

4.5.1 SPECTRUM DISPLAY PP-125 TEST SETUP (Figure 4.2). Figure 4.2 shows the interconnections between the scope main frame, the Interference Analyzer EMC-25, Signal Generator and the Spectrum Display PP-125. Table 4-3 lists all preliminary front panel control settings necessary prior to actual calibration and adjustments of the PP-125. Subsequent paragraphs deal categorically with adjustments related to complete calibration of the PP-125 before it can be used as a Y-plug-in for the 767-H scope.

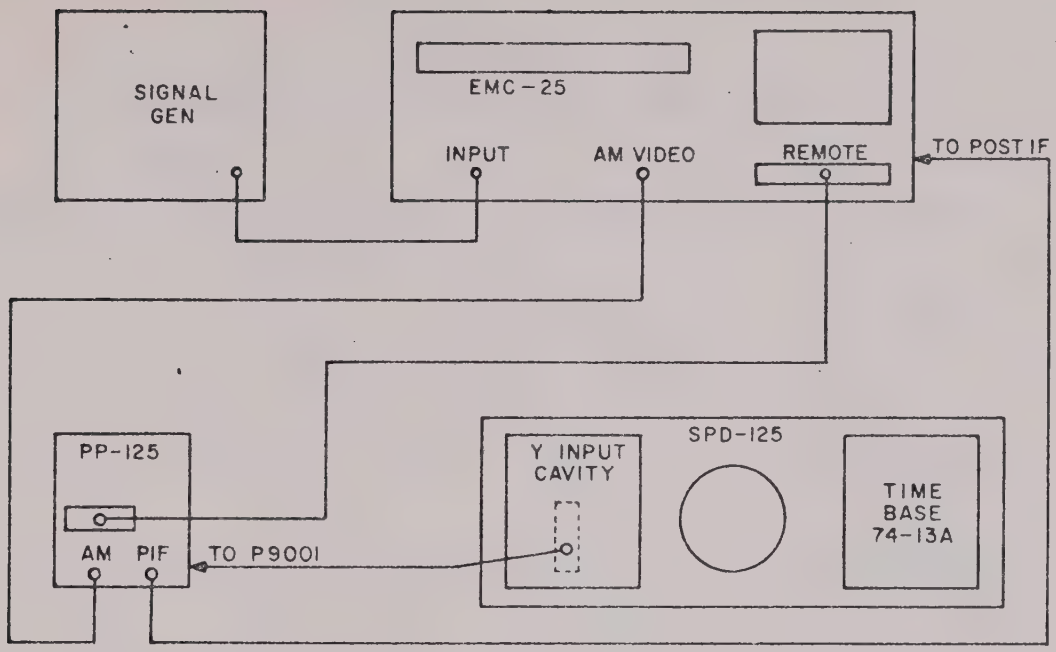


Figure 4.2 Spectrum Display PP-125, Test Setup

4.5.2 SPECTRUM DISPLAY PP-125 SWEEP, CALIBRATION AND ADJUSTMENTS. In the following procedures be certain the horizontal sweep speed is not set too fast. If a change of sweep speed causes a change in the amplitude or shape of the trace presented, the sweep speed should be decreased until no further response change is noted. The maximum permissible sweep speed will vary depending on PP-125 function setting and EMC-25 band and frequency settings.

4.5.2.1 LOG GAIN ADJUSTMENTS

4.5.2.1.1 Preset the log gain control, A1R18, to approximately two full turns CCW from full CW position. This is a screwdriver adjustment on the front panel.

4.5.2.1.2 Set the function switch to VIDEO.

TABLE 4-3

PRELIMINARY FRONT PANEL ADJUSTMENTS

EMC-25		PP-125	
CONTROL	SETTING	CONTROL	SETTING
Attenuator	CAL	Function	Spectrum
Bandwidth	Wide	Video Filter	Off
Bandswitch	60 - 120 KHz	Display	Log
Frequency	80 KHz	Dispersion	As noted in procedures
Detector Function	Carr	Position	As noted in procedures
Tuning Aid	Off	0 - 20 DB's	Both - 20 DB
Tuning Mode	Manual	Atten	Fully CW
Dump	Off		

4.5.2.1.3 Disconnect the cable connected to the AM VIDEO jack of the PP-125. Adjust the POSITION control until the trace is superimposed on the bottom line of the scope graticule ($-\infty$). Reconnect the AM VIDEO cable.

4.5.2.1.4 Insert an 80 KHz, 100 uv signal into the EMC-25 RF input. Adjust the TUNING and CAL controls for full scale (+20 DB) indication on the EMC-25 meter.

4.5.2.1.5 Adjust the video gain control (R14) on the video amplifier assembly (A1A5) until the trace coincides with the top line of the scope graticule (+20 DB).

NOTE

This adjustment interacts with the positioning adjustment. Alternately perform steps 4.5.2.1.2 and 4.5.2.1.4 until no further interaction occurs.

4.5.2.2 TUNING ADJUSTMENT

4.5.2.2.1 Maintaining a full scale reading (+20 DB) on the EMC-25 meter, set the FUNCTION swtich on the PP-125 to SIGNATURE. Rotate the DISPERSION control fully CCW.

4.5.2.2.2 Adjust the tuning balance control (R30) located on the Sweep Control Assembly (A1A4) such that the top of the trace occurs at the vertical center line of the scope.

4.5.2.3 SPECTRUM SWEEP RANGE ADJUSTMENTS

4.5.2.3.1 Set the FUNCTION switch on the PP-125 to Video. Set the FREQUENCY at the EMC-25 to the extreme left against the mechanical stop (lowest frequency). Adjust the signal generator frequency for maximum deflection of the trace.

4.5.2.3.2 Set the FUNCTION switch on the PP-125 to SPECTRUM. Turn the SPECTRUM LF ADJ(R32) on the sweep control assembly (A1A4) until the marker generated by the signal generator is located at the extreme left end of the trace. (The left half of the response will not appear since sweep starts at point of maximum amplitude.)

4.5.2.3.3 Set the FUNCTION switch on the PP-125 to VIDEO. Set the FREQUENCY of the EMC-25 to the extreme right against the mechanical stop (highest fequency). Adjust the signal generator frequency for maximum deflection of the trace.

4.5.2.3.4 Reset the FUNCTION switch on the PP-125 to SPECTRUM. Turn the SPECTRUM HF ADJ (R36) on the sweep control assembly

(A1A4) until the marker generated by the signal generator is located at the extreme right end of the trace.

4.5.2.3.5 Recheck the lower and upper frequency extremes, readjusting as described in 4.5.2.3.2 and 4.5.2.3.4.

4.5.2.4 LOCATOR ADJUSTMENTS

4.5.2.1 Set the FUNCTION switch on the PP-125 to LOCATOR. Turn the DISPERSION control fully CW. Set the FREQUENCY of the EMC-25 to 80 KHz. A short portion of the scope trace near the center will be brighter than the rest of the trace.

4.5.2.4.2 Adjust the contrast control (A1R5) on the front panel of the PP-125 until the dimmer portion of the trace is clearly visible. (A1R5 is a screwdriver adjustment.) There should be a marked difference in contrast between the dim and intensified portion of the trace. A slight adjustment of the scope INTENSITY control may be necessary.

4.5.2.4.3 Adjust the FOCUS and ASTIGMATISM controls on the scope for a clear trace with sharply defined ends to the intensified portion.

4.5.2.4.4 Adjust the LOCATOR WIDTH-WIDE control (R17) located on the sweep control assembly (A1A4) until the intensified portion of the sweep is one centimeter long (one graticule square). The FREQUENCY control on the EMC-25 may be adjusted so the intensified portion of the sweep lies within one graticule square.

4.5.2.4.5 Turn the DISPERSION control on the front of the PP-125 fully CCW. Adjust the LOCATOR WIDTH-NARROW control (R46) located on the sweep control assembly (A1A4) until the intensified

portion of the trace appears as a small dot. This adjustment is made until the dot is as small as possible, but not dimmed.

4.5.2.4.6 Turn the FUNCTION switch on the front of the PP-125 to VIDEO. Insert an 80 KHz, 100 uv signal into the EMC-25. Adjust the TUNING and CAL controls of the EMC-25 for a full scale deflection of the meter.

4.5.2.4.7 Turn the FUNCTION switch located on the front of the PP-125 to LOCATOR. With the DISPERSION control fully CCW, adjust the LOCATOR POSITION control (R27) on the sweep control assembly (A1A4) until the intensified dot is positioned at the very top of the response curve (trace).

4.5.2.5 SIGNATURE ADJUSTMENTS

4.5.2.5.1 Set the FUNCTION switch located on the front of the PP-125 to SIGNATURE. Set the DISPERSION fully CCW. Set the BANDWIDTH switch in the front of the EMC-25 to NARROW. The resulting expanded response should reach its maximum amplitude at the vertical center graticule line on the scope. A slight readjustment of the TUNING BAL control (R30) on the sweep control assembly (A1A4) can be made if necessary.

4.5.2.5.2 Rotate the DISPERSION control on the front of the PP-125 fully CW. Adjust the SIGNATURE SYMMETRY control (R26) on the sweep control assembly (A1A4) so the maximum amplitude point of the trace remains at the center vertical graticule line on the scope.

4.5.2.5.3 Set the FUNCTION switch on the front of the PP-125 to LOCATOR. Readjust the signal generator frequency until the maximum

amplitude point of the trace occurs at the extreme left end of the intensified portion. If the amplitude of the trace decreases when the FUNCTION switch setting is changed, decrease the horizontal sweep speed of the SPD-125 until the amplitude of the trace remains constant for different FUNCTION settings.

4.5.2.5.4 Set the FUNCTION switch on the front of the PP-125 to SIGNATURE. Adjust the SIGNATURE RANGE control (R19) on the sweep control assembly (A1A4) until the maximum amplitude of the trace occurs at the extreme left end of the trace. Readjust controls according to paragraphs 4.5.2.1 through 4.5.2.5.4 until all interaction ceases.

4.5.2.5.5 Set the FUNCTION switch on the front of the PP-125 to LOCATOR. With the DISPERSION still fully CW, readjust the signal generator frequency until the maximum amplitude of the trace occurs at the extreme right end of the intensified portion.

4.5.2.5.6 Set FUNCTION switch on the front of the PP-125 to SIGNATURE. The maximum amplitude of the trace should occur at the extreme right end.

NOTE

To achieve the above condition of coincidence between the maximum amplitude point and the extreme right end of the intensified portion of the trace, slight readjustments of the TUNING BAL (A1A4R30), SIGNATURE SYMMETRY (A1A4R26), SIGNATURE RANGE (A1A4R19), and LOCATOR WIDTH-WIDE (A1A4R17) may be required. The most optimum alignment is desired.

4.5.3 SPECTRUM DISPLAY PP-125, IF GAIN ADJUSTMENTS

4.5.3.1 The initial settings of the PP-125 and associated equipment should be as described in Table 4-2.

4.5.3.2 175 KHz IF GAIN ADJUSTMENT

4.5.3.2.1 Disconnect the AM VIDEO cable from the PP-125. Adjust the POSITION control on the PP-125 until the trace is superimposed on the bottom line of the scope graticule (- ∞). Reconnect the AM VIDEO cable.

4.5.3.2.2 With a 100 uv 80 KHz input signal to the EMC-25, adjust the EMC-25 CAL control until the scope trail deflection caused by the input signal is full scale with the display switch in LOG position.

4.5.3.2.3 Set the DISPLAY switch to LIN. Adjust the 175 MHz GAIN control (A1A3R9) until the marker amplitude coincides with the third line from the top of the scope graticule (100%).

4.5.3.3 1.6 MHz IF GAIN ADJUSTMENT

4.5.3.3.1 The procedure for adjustment of the assembly is the same as that for the 175 KHz IF assembly with the following exceptions.

4.5.3.3.2 The EMC-25 bandswitch is set to band 8 (2.3 to 5.3 MHz).

4.5.3.3.3 The signal generator is set to 4.0 MHz maintaining 100 uv output.

4.5.3.3.4 Adjust the 1.6 MHz GAIN control (A1A2R9) until the marker amplitude corresponds to the third line from the top of the scope graticule (100%).

4.5.3.4 8.7 MHz IF GAIN ADJUSTMENT

4.5.3.4.1 The procedure for adjustment of this assembly is the same as that for the 175 KHz IF assembly with the following exceptions.

4.5.3.4.2 The EMC-25 bandswitch is set to band 11 (22 to 51 MHz).

4.5.3.4.3 Set the signal generator output to 40 MHz with an amplitude of 100 uv.

4.5.3.4.4 Adjust the 8.7 MHz Gain control (A1A1R9) until the marker amplitude coincides with the third line from the top of the scope graticule (100%).

4.5.4 RECORDER INPUT ADJUSTMENTS

4.5.4.1 RECORDER INPUT ADJUSTMENT TEST SET UP (Figure 4.3). Figure 4.3 shows the required test setup for adjustments necessary prior to the use of an X-Y recorder.

4.5.4.1.1 Set the scope vertical input to DC. Calibrate the scope such that the bottom line on the scope graticule corresponds to OV and that 1.5V can be read accurately.

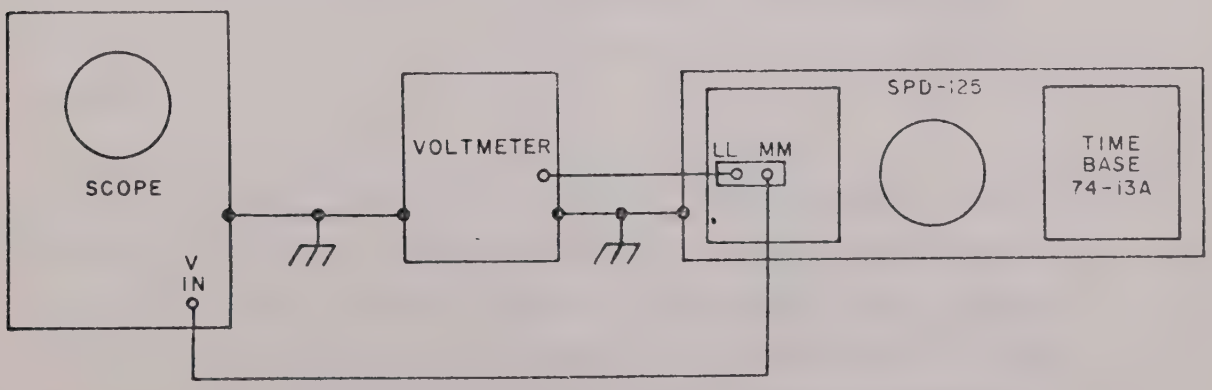


Figure 4.3 Recorder Input Adjustments, Test Setup

4.5.4.1.2 Synchronize the scope sweep so the X output of the PP-125 (J6-MM) appears as two cycles of sawtooth on the scope.

4.5.4.1.3 Adjust the X-OUT ZERO ADJ (R9) on the sweep control assembly (A1A4) until the peaks of the sawtooth voltage reach 1.5 V. Readjust R9 and R1 as needed to insure a 0 V to 1.5 V sawtooth.

4.5.4.1.4 Adjust the POSITION control on the front of the PP-125 until the SPD-125 trace coincides with the bottom graticule line.

4.5.4.1.5 Adjust the Y-OUT ZERO ADJ (R26) of the Video assembly (A1A5) until a voltmeter (connected to J6-LL) reading of 0 V is obtained.

4.5.4.1.6 Readjust the POSITION control on the fron of the PP-125 until the SPD-125 trace coincides with the top line of the graticule.

4.5.4.1.7 Adjust the Y-OUT GAIN ADJ (R22) on the Video assembly (A1A5) until the voltmeter reading obtained is 1.5 volts.

4.6 TROUBLESHOOTING

4.6.1 Whenever a malfunction occurs, it can readily be isolated to a particular assembly. The following paragraphs contain suggested procedures to be followed that will isolate a trouble to a particular assembly.

4.6.1.1 IF AMPLIFIER MALFUNCTION. If a malfunction is suspected to be within one of the IF amplifier assemblies, the procedures outlined in Section 4.3 may be followed. If the adjustments contained in 4.5.3.2 fail to respond, the malfunction is in the 175 KHz amplifier assembly. Isolation of the malfunction to the 1.6 MHz IF amplifier

assembly can be achieved if the instrument does not respond to the procedure outlined in paragraph 4.5.3.3. Isolation of the malfunction to the 8.7 MHz IF amplifier assembly can be achieved if the instrument does not respond to the procedure outlined in paragraph 4.5.3.4.

4.6.1.2 VIDEO AMPLIFIER MALFUNCTION. Using the test set up in Figure 4.2 and injecting AM VIDEO from the EMC-25, the IF Amplifiers are bypassed completely. If the trace on the SPD-125 does not conform, the trouble is contained in the Video amplifier assembly.

4.6.1.3 SWEEP CONTROL MALFUNCTION. If the malfunction is suspected to be in the sweep control assembly, the procedures outlined in paragraph 4.5.2 may be followed. If one of them fails to respond, the malfunction is located in the sweep control assembly.

4.7 ASSEMBLY REPAIR

4.7.1 The repair of the suspected assembly can be effected only after the problem is isolated to a stage or a single component part. The usual signal tracing, voltage and/or continuity checking will, under normal circumstances, isolate the trouble to a functional stage within the defective assembly. Care must be taken not to damage the circuitry on the individual assemblies whenever replacement of component parts are undertaken.

4.7.2 Individual assemblies may be purchased to replace any that are defective. Defective assemblies may be returned to the factory for repair or replacement.

4.7.3 New or repaired assemblies must be subjected to a complete calibration and adjustment as outlined in this section, whenever they are returned to use as an integral part of the Spectrum Analyzer, GSR-200.

SECTION V
REFERENCE DATA

5.1 GENERAL

5.1.1 This section contains information which will be helpful in signal tracing during instrument checkout and/or maintenance. Figure 5.1 is a schematic location guide followed by electrical drawings. These electrical drawings are presented, as near as possible, in the order of signal flow within the instrument. Physical location according to designators was also considered.

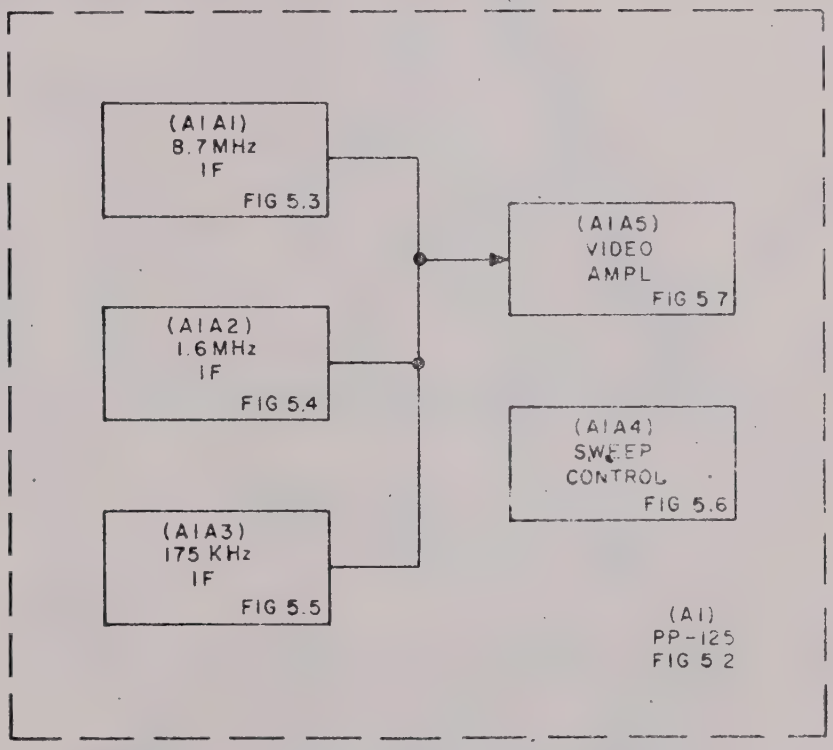
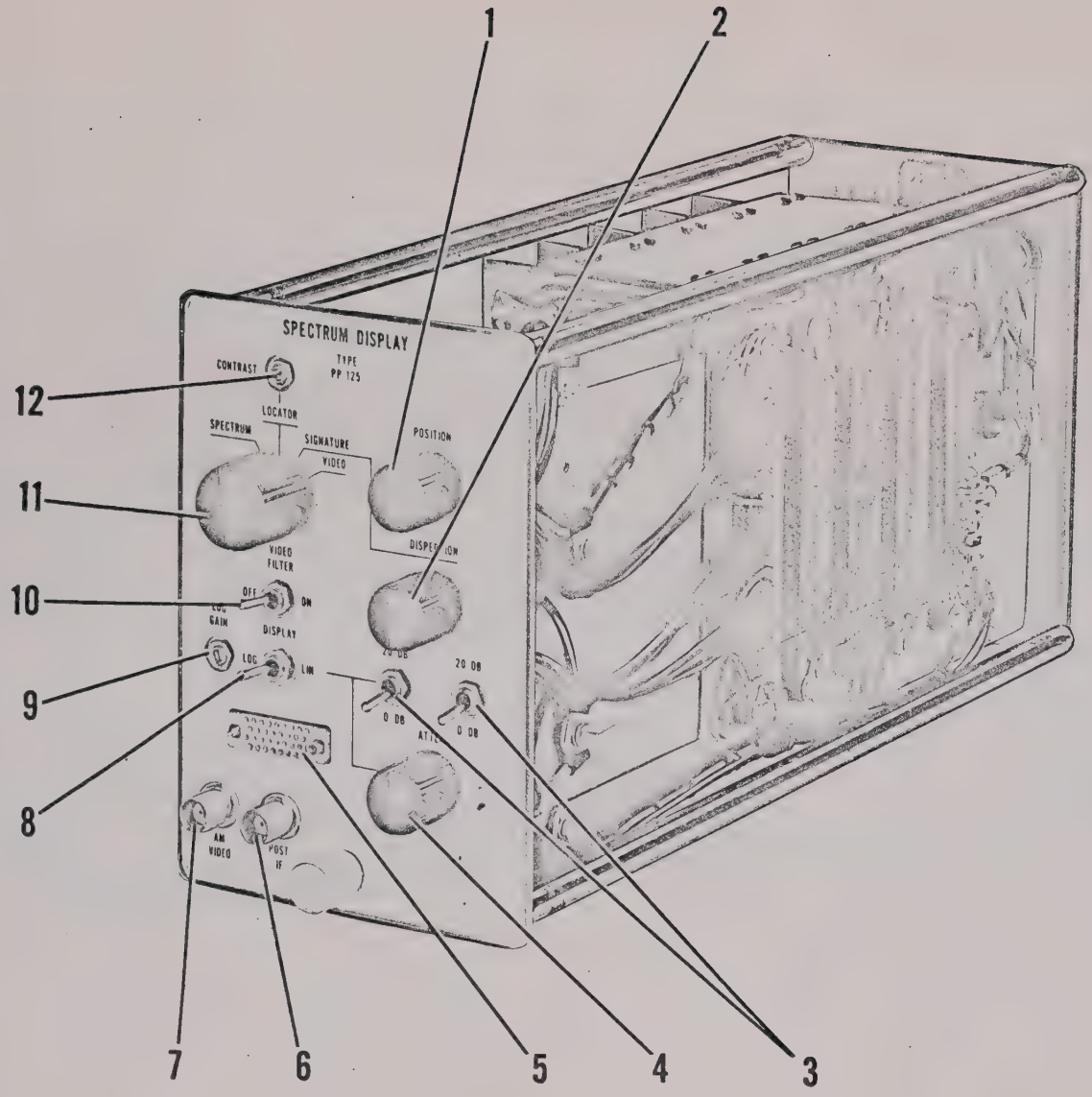


Figure 5.1 Schematic Location Guide

5.1.2 As an example, to locate the schematic of the video amplifier (A1A5), check the block titled video amplifier for the figure number (Figure 5.7).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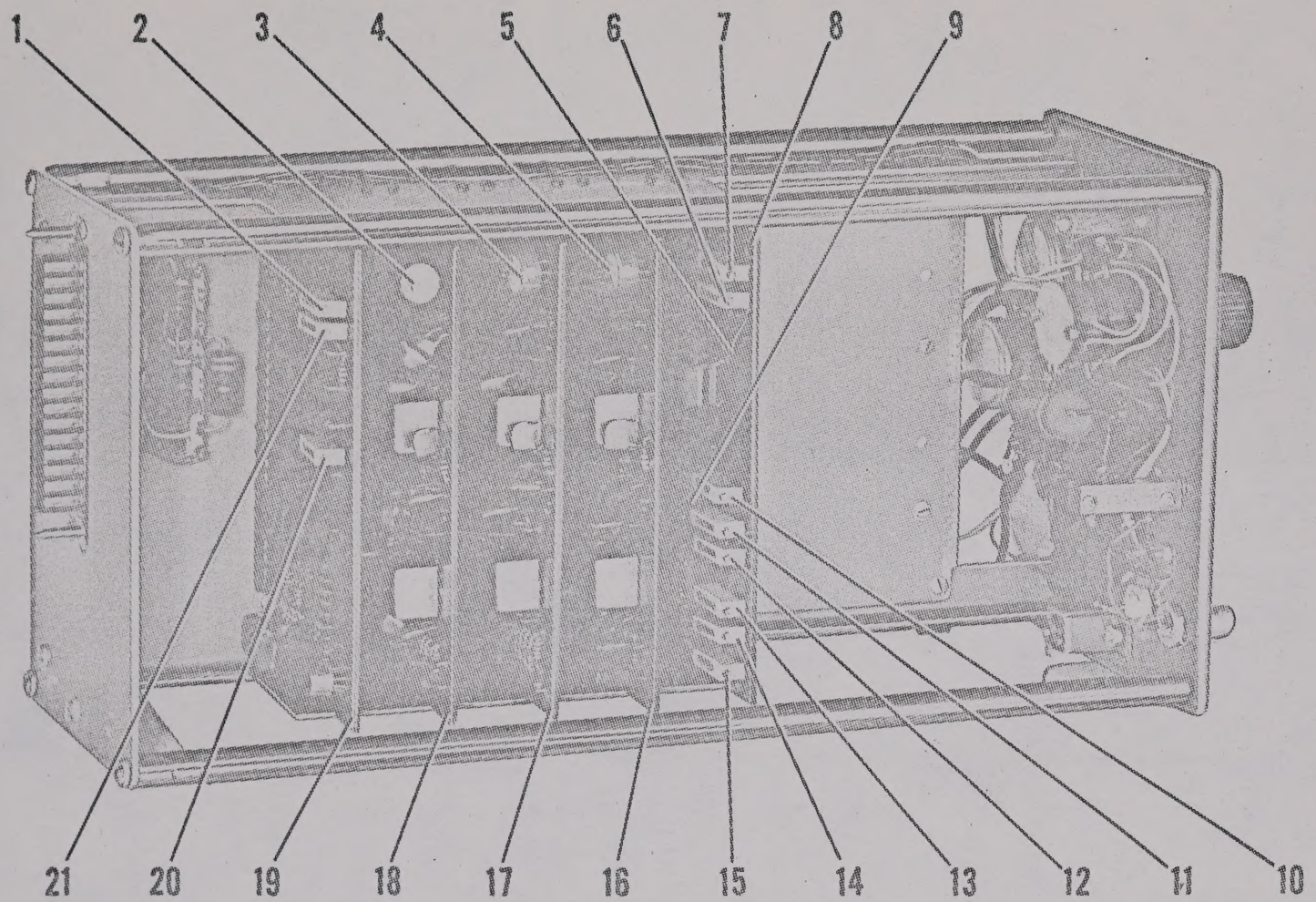
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